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Cooperation of Fighter Aviation  
and Surface-to-Air Missile Troops

by

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The problems of establishing reliable air defense of our troops, treated in the article by General-Leytenant of Artillery P. Levchenko\*, and also in the articles of other authors, are highly urgent and deserve the greatest attention. At the same time we cannot agree with the point of view of these authors on such important questions as the methods of cooperation of surface-to-air missile units and front fighter aircraft, ensuring the safety of flights by aviation in the zones of operations of our surface-to-air missile and antiaircraft artillery units, and allocation of fighter aircraft to the chief of the air defense troops of a front (army) in support of the air defense of the troops.

In order to clarify these questions it is necessary to describe, if only in the briefest outline, the conditions in which the air defense troops and fighter aviation have to cover troops and other front installations, and to examine the capabilities and more desirable methods of the cooperation of fighters and surface-to-air missile units in accordance with their tactical characteristics.

Based on the tactics of the probable enemy and the experience of numerous NATO exercises, one can assume that the first echelon of enemy aviation, operating in groups of four to eight aircraft, will attempt to neutralize our air defense control system by jamming and fire, deliver strikes against surface-to-air missile positions and airfields, and immobilize in battle or divert our fighters in the air. One should anticipate actions primarily by tactical fighter and reconnaissance aircraft in the enemy first echelon; the second and subsequent echelons most often will consist of strike groups, the combat formations of which may also contain a considerable number of support aircraft.

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In this type of attack the enemy, using reconnaissance data, will select advantageous flight paths which are less densely covered by the fire of ground air defense means, tighten up the flow of aircraft (groups) to hamper the switching of fire by surface-to-air missile units from one target to another, use low altitudes, and also resort to various deception measures and other tactical procedures. As can be seen from the foregoing, the situation thus can prove to be highly complicated, nevertheless, the air defense system must ensure destruction of the maximum number of enemy means of air attack while they are still on the approaches to the installations being covered, and reduce to the minimum the damage which can be inflicted on troops and other front installations.

Analysis of air defense forces and means shows that successful repulse of an air enemy is possible only by integrated employment of them and close cooperation, with fullest utilization of the combat characteristics inherent in these forces and means.

It is known that fighters, owing to their high maneuverability and relatively wide radius of actions can wage a battle in places where fire superiority over the air enemy must be achieved, and where the coverage of troops by ground air defense means has been weakened or the enemy has succeeded in breaching the battle formations of the surface-to-air missile units. At the same time surface-to-air missile units repelling an attack cannot react quickly to a change in the heading of an air enemy because of known technical limitations on maneuvering.

Fighters can operate with limited radar support, and even in the absence of continuous radar tracking of targets, by employing independent search of the air enemy. But the conduct of combat actions by surface-to-air missile units requires constant radar surveillance of air targets.

Fighter aviation operating against a group target can concentrate on it the necessary number of aircraft until the target is completely destroyed or damaged in such a way that it loses its combat effectiveness. The continuity of fighter<sup>50x1-HUM</sup> actions against an air enemy is achieved specifically by allocating their efforts by time of attack in such a way as to attack each group or only the one representing the greatest

danger. But surface-to-air missile systems firing at group targets, because of the limitation on the possible number of targets which can be struck simultaneously and because of the time required to switch fire from one target to another, are not always able to completely destroy a group as it passes through the kill zone of the surface-to-air missile unit.

Hence it follows that the capabilities of each air defense means must be realized in joint combat actions on the basis of precise cooperation to ensure continuous and repeated delivery of strikes against the combat formations of enemy aircraft.

Repetition of fire action against an air enemy to repel his attack is achieved by echeloning air defense means in depth. To this end, for reliable coverage of troops and other front installations, and particularly for destruction of low-flying targets, it is desirable to establish two or three echelons of air defense means (Figure 1).

In the first echelon, forward of the front line and beyond the limits of the launching zones of the forward surface-to-air missile systems, only fighters operate. This forward echelon basically is intended for independent search and destruction of enemy aircraft on the distant approaches to their targets and for disruption of their combat formations.

The second echelon of air defense means operates from immediately at the front line (within the launching and kill zones of the surface-to-air missile systems) up to the rear boundary of the army air defense zone, about 80-100 kilometers. Here are situated both the fire positions of the surface-to-air missiles and antiaircraft artillery, and the airborne alert zones of the fighters. To destroy low-flying targets, fighters fly at altitudes of 1,500-2,000 meters, calculated so that the forward limit of the airborne alert zone is beyond the kill zone of enemy low-altitude systems. To destroy targets at high altitudes, fighters usually are on airborne alert over their own territory at altitudes of 10-12 kilometers, beyond the kill zone of Nike-Hercules type surface-to-air missile systems, which wo<sup>11</sup> place the center of the zone approximately 50-60 kilometers<sup>11</sup> inside our territory. In anticipation of or during an enemy attack, fighter alert zones can be shifted to enemy territory.

The third echelon of air defense means is positioned behind the second to the depth of the operational disposition of the front troops. Its purpose is to destroy targets which have broken through the first two echelons. In the third echelon operate fighter aviation (mainly from airfield alert status) and surface-to-air missile units covering the second echelons, reserves and other front installations.

Such organization of coverage of the troops corresponds to the greatest extent to the nature of the tasks of present-day air defense and allows continuous action against an air enemy during his entire flight toward his strike targets.

Highly important, in our view, are the questions concerning methods of cooperation of fighter aviation and ground air defense means, and about recognition systems and systems for ensuring the safety of flights by our own aviation in the zones of surface-to-air missile units.

General P. Levchenko thinks that of the two basic methods of cooperation of fighters and surface-to-air missile units (by zones and in a single zone), the first is the simpler, since "surface-to-air missile units (large units) and fighter aviation can realize their combat capabilities without interfering with each other." Further, the author concludes that "this will obviously be the basic method of cooperation under the new organizational structure of Ground Forces air defense units. Cooperation in a single zone with the introduction of new SAM systems into service with Ground Forces air defense will occur...very rarely, because the allocation of the efforts of surface-to-air missiles and fighters in a single zone... is practically impossible, given the present means of control. To accomplish this, it is necessary that...control...be fully automated...and that all missile guidance stations be provided with a radar recognition system."

Other authors contend that fighters will conduct combat actions in the missile firing zone whenever the specific situation requires.

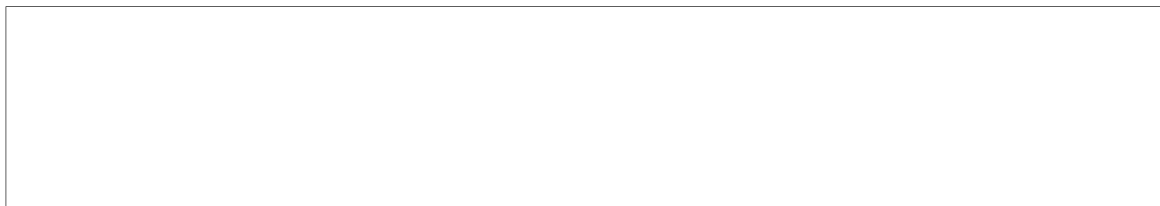
This kind of oversimplified approach hampers solution of such an important problem. In the first place, cooperation by zones creates for the enemy advantageous conditions for

negotiating our air defense: at first he sets up combat formations and carries out maneuvers against the fighters operating forward of the zone of the surface-to-air missile units, and upon entering this zone (the positions of the missile units now being difficult to conceal from reconnaissance), he employs only evasive maneuvering, since our fighters no longer threaten him. In the second place, cooperation by zones seems the simpler method only at first glance. It is impossible to imagine the boundary of the zones of fighter aviation and surface-to-air missile units as a barrier marked on the terrain, before which fighters disengage, relinquishing the targets under attack.

In the third place, after disengagement fighters will nevertheless be forced to return to their own airfields in no way other than through the zones of the surface-to-air missile units. Therefore, even in the first air defense echelon, cooperation can occur in a single zone at the same time as the cooperation of fighter aviation and surface-to-air missile units by zones, which permits the greatest realization of the combat capabilities of these basic active air defense means. But cooperation in the second air defense echelon, as a rule, will be accomplished in a single zone, since precisely here are situated the fighter alert zones and the majority of the fire positions of the surface-to-air missile units and antiaircraft artillery, and to organize cooperation by zones under these conditions, it seems to us, is simply impossible.

The essence of the cooperation of fighters and surface-to-air missile units in a single zone will consist in the allocation of their efforts by targets and altitudes, and in support of actions against a single large target. The most complicated is the concentration of efforts against a single target. The necessity of actions against a single target is occasioned by the fact that only with the combined efforts of fighter aviation and surface-to-air missile units is it possible to damage a large group of enemy aircraft to such an extent that it will be unable to carry out its combat mission.

To assess the capabilities for cooperation of fighter aviation and surface-to-air missile units in concentrating efforts against a single target, the Military Air Academy performed calculations on the attack of air targets from the rear and forward hemispheres in fighter actions from airborne alert



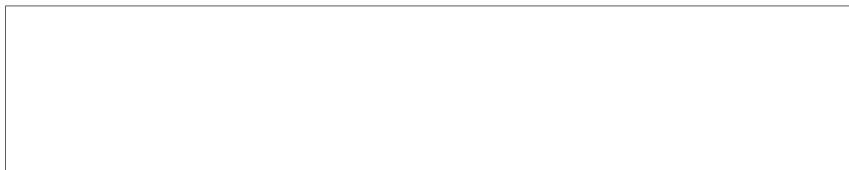
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and airfield alert status. The calculations showed that three variants are possible under these conditions: fighters attack targets forward of the kill zones, in the kill zones and behind the kill zones of the surface-to-air missile units.

The allocation of fighter efforts to intercept targets under these conditions essentially depends on the operating methods of the fighters, the directions of their attacks (from the rear or forward hemisphere), the make-up of the targets, and their flight altitudes and speeds. When attacking targets flying at altitudes of 10-14 kilometers and speeds of 1,300 kilometers per hour, fighters in the rear hemisphere, operating from airborne alert zones, can destroy them and disengage from the attack up to the far border of the kill zone (Figure 2, positions I and II). When target speeds are greater than 1,300 kilometers per hour, the fighters will intercept them in the kill zones of the surface-to-air missile units and behind the zones (Figure 2, position III). In this case fighters are brought out to a departure position to attack targets at distances of no less than six to eight kilometers, and they launch missiles from a range of four to six kilometers.

The organization and implementation of cooperation at low altitudes has its own specific features. If it is taken into consideration that the majority of low-flying targets are not detected by radar stations or are detected briefly, the capabilities for centralized control of field air defense means are extremely limited, especially in repelling massed attacks. But fighters usually will operate by the independent search method, and control of them from guidance posts consists only in rendering assistance in maintaining the general combat formation in the zone of operations. Under these conditions it is desirable to implement cooperation of surface-to-air missile units (subunits) and fighters in a single zone by consecutive actions, assigning lines for the commencement and termination of actions for each of the air defense means.

Accordingly, fighters operating by the independent search method in the first echelon break off the attack of targets in enemy territory 25-30 kilometers from the front line and report this by radio when advising their locations (Figure 2, position IV). Surface-to-air missile (artillery) units and subunits<sup>50X1-HUM</sup> operate from the limit of target detection by ground radar



stations, by the battery target detection radars of the surface-to-air missile systems, and by the radar sights of ZSU-23-4 artillery systems, to the line of the battle formations of the surface-to-air missile units assigned to large units of the first echelon of the army (a depth of 10-20 kilometers from the front line). Fighters operate on airborne alert from the line of the launch sites of the surface-to-air missile battalions, at altitudes of 1,500-2,000 meters (Figure 2, position V). In this case the depth of fighter actions against low-flying targets may be limited by the combat action zone of the surface-to-air missile units covering installations in the rear of the front.

In attacking targets from the forward hemisphere at the high and low altitudes indicated above, fighters operating from airborne alert status can destroy any enemy aircraft up to the far border of the kill zone of the surface-to-air missile unit. But we should remember that if fighters have all-angle of approach weapons, they initiate the attack from their own territory outside the kill zone of the surface-to-air missile unit. Arming fighters with such weapons would require a great deal of refinement in the organization of cooperation, but even now it is already clear that in attacking radar-covered targets from the forward hemisphere, the cooperation of fighters and surface-to-air missile units also can be implemented only in a single zone.

Thus, we have revealed not only the necessity, but also the feasibility of actions by fighters and surface-to-air missile units in a single zone to repel an air enemy, especially his massed attacks.

Ensuring the safety of the flight of our aircraft of all types of aviation in the zones of operations of surface-to-air missile units is no less important a task, but one which is not so simple to carry out. We should not think that the establishment of a stricter sequence in our aviation flights by appropriate corridors and altitudes, and timely reporting to regimental and battalion fire means of the sequence and time of flight of our aviation in the zones of formations, large units and units, are all that is required to ensure the safety of actions of our aircraft and success in battle with the enemy.



We also have to adhere to a strict sequence for firing against aircraft in the air, particularly by antiaircraft units. This, obviously, requires installing interrogators on all missile guidance and antiaircraft artillery fire control radars, which will afford the capability of recognizing aircraft even when they are flying at short distances from each other. Surface-to-air missile systems and aircraft also need equipment to guarantee safety to our own aircraft in both accidental and deliberate entry into the kill zone of surface-to-air missile troops. This equipment must ensure safe disengagement of the fighter from a zone within a 600-meter radius of the target under fire by a surface-to-air missile system by blocking the radar proximity fuze and launcher as the missile is being guided or by blocking the illumination of our aircraft by the missile guidance radar.

Overflight of the combat action zones of surface-to-air missile units by corridors (as several authors have proposed) is not appropriate to the tactics of front, long range and military transport aviation. Thus, the flight of fighter-bombers along established corridors at the request of the troops results in their delay, and guidance of modern fighters according to a certain mandatory program (with approach to the target along the most favorable trajectory) virtually excludes the possibility of overflight in established corridors. It is even more impossible to add the return flight paths of the aircraft to the established corridors. Hence follows the conclusion that the allocation of flight corridors hinders aviation actions in a combat situation, results in a pattern and gives the enemy an opportunity to concentrate his efforts on intercepting our aircraft in these corridors.

As for timely warning of ground forces units and subunits about flights of our aircraft, this obviously will result in revealing to the enemy the nature of the impending flights of our aviation. Furthermore, a single warning in no way compensates for the absence of recognition devices on air defense fire means.

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The seriousness of this problem may be confirmed by an example from the experience of the exercises for ground forces air defense troops in the Baltic Military District, when from a total number of targets "fired upon" by surface-to-air missiles and antiaircraft artillery (under the existing system of recognition and warning) up to 25 percent of our own aircraft

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were "fired upon". We cannot be reconciled to such a situation, of course.

It seems to us that until a more sweeping solution to the recognition problem is found, we must accept the existing air recognition systems into service in the ground forces.

And finally, we should briefly examine the desirability of allocating fighter aviation for air defense purposes to the operational subordination of the chief of the air defense troops of a front.

This statement of the question is motivated by the fact that this will create favorable conditions for organizing the cooperation of all active air defense means. But we must not fail to consider that the subordination of a certain portion of the fighter aviation to the chief of the air defense troops of a front will lead to further resubordination of these aircraft to the chiefs of the air defense troops of the armies, who naturally will try to employ the fighter aviation only in support of one's own army. This clearly would dissipate the forces. The maneuverability of fighter aviation as a front means would thereby be lost. It is well known that in performing the tasks of covering the troops against enemy air strikes, fighter aviation is used massively on those axes where the greatest threat of a breakthrough of the front air defense is developing. Therefore, its control must be centralized in the hands of the commander of the air army (the deputy commander of the air army for air defense) and implemented with provision for the state of readiness of air units at any given time.

We also must not fail to consider the fact that front fighter aviation, besides covering troops, will be charged with supporting other types of aviation, as well as conducting reconnaissance, combating enemy air transportation, and so on. All this indicates that placing individual fighter aviation units or large units in operational subordination to the chief of the air defense troops is undesirable.

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One of the basic problems, which if solved will permit reducing the difficulties of organizing joint combat actions, is the problem of implementing centralized control of all the air defense forces and means of a front. It is now recognized that

such control should be initiated by collocating the control posts of active air defense means. At the colocated control post, the chief of the front air defense troops and the deputy commander of the air army resolve the problems of planning and operational cooperation of fighter aviation and surface-to-air missile units in support of the front. Fighter aviation and surface-to-air missile unit tasks to destroy specific targets at high altitudes, as practice shows, are better allocated from the colocated forward command post of the commander of the fighter aviation division and the command post of the chief of the army's air defense troops. If, when destroying low-flying targets, target allocation will be too difficult from this control post, then it will have to be carried out from the colocated guidance post of the fighter aviation division and command post of the surface-to-air missile regiment (battalion). In this case the colocated army air defense control post will warn the surface-to-air missile battalions about the positioning of fighters in alert zones, targets the fighters are working against and our aviation flight paths through the front line, etc; and it will advise the fighter aviation guidance posts as to the targets the surface-to-air missile systems of each battalion are firing or supposed to fire against.

The desirability of collocating posts under the existing organizational structure is corroborated by exercises conducted in the Air Forces and in the air defense troops of the Ground Forces, as well as by the operating experience of control posts in the Air Defense Forces of the Country. Besides centralizing the control of air defense means, collocating the control posts makes it possible to receive identical data on the air situation, and to reduce the time spent on all kinds of coordinations between the control posts of cooperating means (and in most cases eliminate these coordinations).

The experience acquired urgently requires that future control systems be developed from the standpoint of eliminating the deficiencies inherent in the dissociation of the control of fighter aviation and surface-to-air missile units, and that provision be made for centralized warning of air defense troops and means about the air enemy, processing and issue to control posts of data on enemy flights and our own aircraft, allocation of the efforts of air defense forces and means, as well as cooperation of fighter aviation and surface-to-air missile units

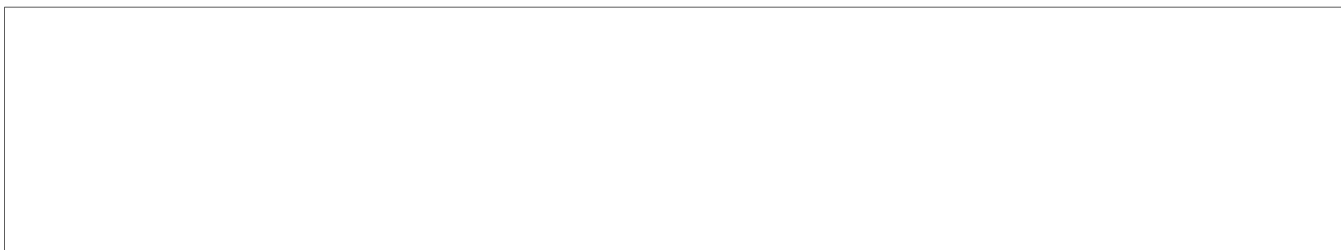


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by zones and in a single zone, and concentration of fire against the most dangerous targets. No less important a requirement of such a system is resistance to the casualty-producing elements of nuclear weapons and high reliability under conditions of enemy jamming.

Solution of the problems examined above, in our view, will permit more effective cooperation of fighter aviation and ground air defense means during joint actions to fulfil the tasks of destroying an air enemy.

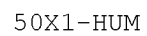
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Key to Figure 1

1. First echelon
2. Second echelon
3. Third echelon
4. Reserve in the air, altitude 5-6 kilometers
5. Jammer aircraft, altitude 5-10 kilometers
6. Tactical aviation overflight zone, altitude 50-100 meters
7. Independent search zone
8. Kill zone of surface-to-air missile system (short-range)
9. Colocated command post of surface-to-air missile regiment and guidance post of fighter air division
10. Colocated command post of surface-to-air missile brigade and guidance post of fighter air division
11. Colocated army air defense command post and forward command post of fighter air division
12. Kill zone of surface-to-air missile system (medium range), altitude 3-23 kilometers
13. MIG-21, altitude 1.5-2 kilometers
14. MIG-21, altitude 10-11 kilometers
15. Command post of fighter air division
16. Command post of surface-to-air missile regiment
17. Tank division
18. Kill zone of short-range surface-to-air missiles and ZSU-23-4

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# Key to Figure 2

1. Far boundary of the launching zone
2. Altitude (in kilometers)
3. Interception in the stratosphere
4. Altitude 10-11 kilometers
5. Conventional symbol for a group of enemy aircraft
6. Altitude 1.5-2 kilometers
7. Distance, in kilometers

Cooperation of fighters and surface-to-air missile units in a single zone

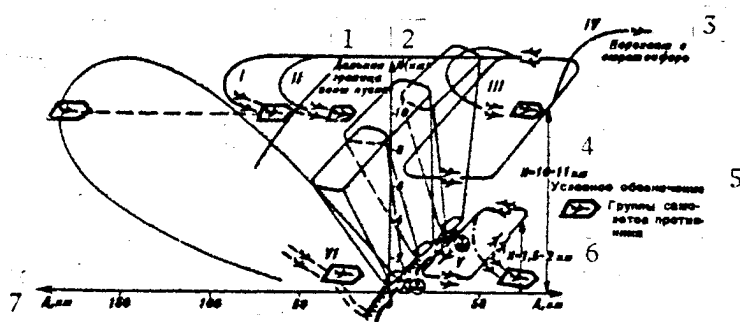


Рис. 2. Взаимодействие истребителей и ЗРК в одной зоне

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